Erie bay.—Erie, Pennsylvania: the bay was closed by ice during the night of the 20–21st.

Cuyahoga river.—Cleveland, Ohio: the river froze over during the night of the 16–17th.

Sandusky bay.—Sandusky, Ohio: all steamers except the "American Eagle" went into winter quarters on the 15th; navigation practically closed for the season.

Maumee river.—Toledo, Ohio: the river closed on the 17th.

Detroit river.—Detroit, Michigan: floating ice was observed in the river on the 20th and 21st.

Saint Clair and Black rivers.—Port Huron, Michigan: the Black river froze over on the 18th; floating ice in Saint Clair river on the 22d.

Thunder bay and Thunder Bay river.—Alpena, Michigan: floating ice in river and bay on the 14th; river partly frozen on 15th; bay partly frozen on 17th; navigation closed on 19th.

Saint Mary's river.—Fort Brady, Michigan: teams crossed the river on the ice from the 22d to the close of the month.

Straits of Mackinac.—Mackinaw City, Michigan: ice formed along the shores on the 14th; on the 18th the straits were covered with thin ice.

Lake Superior.—Duluth Minnesota: on the 17th the lake was frozen for a distance of three miles from the shores; on the 28th it was filled with floating ice as far as the eye could reach.

Marquette, Michigan: the steamer "Samuel Hodge" left port on the 3d, for the lower lakes, being the last departure of the season.

Lake Michigan.—Milwaukee, Wisconsin: ice formed along the shores of the lake on the 17th.

Chicago, Illinois: navigation was practically closed on the 15th.

Grand river.—Grand Haven, Michigan: drift ice was observed in the river on the 19th; on the 22d the river froze over, but the ice broke up on the 24th.

Lansing, Michigan: the river closed on the 16th.

Mississippi river.—Saint Paul, Minnesota: the river was frozen from the 1st to the 31st; on the 11th the ice melted around the harbor and near the river gauge, so that observations were made for a few days, but the harbor froze over again on the 14th.

La Crosse, Wisconsin: the river froze over on the 18th, and remained so after that date.

Dubuque, Iowa: floating ice on the 1st, 3d, 4th, 5th, and 17th; river froze over on the 19th; teams crossed on the ice on the 20th.

Davenport, Iowa: the last steamer of the season left this place on the 2d; floating ice was observed from the 3d to 18th; on the 24th the river was frozen solidly and teams crossed on the ice.

Muscatine, Iowa: the river froze over on the 19th; on the 21st teams crossed on the ice.

Burlington, Iowa: floating ice on the 15th; river closed on the 18th.

Keokuk, Iowa: navigation closed for the season on the 14th; ice-dams formed above the city on the 19th and 21st, causing the water to fall below the low-water mark of 1864 on the latter date.

Saint Louis: the first floating ice was observed on the 18th; on that date navigation was practically suspended for the season; floating ice continued until the 26th, when the river was nearly free of ice; light floating ice was observed on the Illinois side on the 27th, 28th, and 29th; on the 30th and 31st the river was clear of ice.

Cairo, Illinois: navigation between this city and Saint Louis closed on the 30th.

Des Moines river.—Des Moines, Iowa: the river froze over on the 18th.

Missouri river.—Yankton, Dakota: an ice-dam formed in the river on the 15th; the river remained frozen after the 16th.

Vermillion, Dakota: the river closed on the 17th.

Omaha, Nebraska: the river froze over on the 30th.

Rock river.—Rockford, Illinois: the river froze over on the 16th.

Ohio river.—Cincinnati, Ohio: much floating ice was observed on the 24th.

Tuscarawas river.—Canal Dover, Ohio: the river froze over on the 13th, but was again clear of ice on the 25th.

At Wellsborough, Tioga county, Pennsylvania, on the 30th, ice was reported to be about five inches thick.

FLOODS.

Galveston, Texas, 6th.—Reports from Dallas stated that that city was partly flooded by a heavy rain storm which occurred during the night of the 5–6th. A large amount of damage was done to buildings, sewers, etc. The streams in the surrounding country were much swollen, flooding the railroad tracks and delaying trains from six to eight hours.

Cincinnati, Ohio.—On the 24th the Licking river, which empties into the Ohio opposite this city, rose twenty-six feet. Many barges and other river craft were broken from their moorings and swept away by the strong current. Very heavy losses were sustained by the owners of barges, etc. The Ohio river reached its highest point on the morning of the 28th, when all the buildings nearest the river between Main street and the suspension bridge, and between Broadway and Ludlow street, were flooded.

Laconia, Harrison county, Indiana, 24th.—The Ohio river has risen about twenty feet opposite this place during the last forty-eight hours.

Vevay, Switzerland county, Indiana.—On the 24th cellars, culverts, etc., at this place were flooded and much damage was done. The Ohio river rose nearly to the top of its banks on that date, and an inundation was threatened.

Wickenburg, Arizona.—The heavy rains of the 21st and 22d caused Hassayampa creek (which in this vicinity, has been completely dry for several months) to rise to such an extent that it could not be forded. It continued high during the 23d, but it fell rapidly on the following day.

Plymouth, Grafton county, New Hampshire.—The village reservoir, having an elevation of nearly two hundred feet, was washed out during the night of the 27–28th, owing to the heavy rains which melted the snow, and caused an overflow.

HIGH TIDES.

Eastport Maine, 13th, 14th.

LOW TIDES.

New York City.—The westerly gale of the 28th caused a very low tide about the shores of Staten Island. For the second time during the past year Split Rock, off Tompkinsville, was above the water line. This rock is generally seen about once in seven years. New Creek shoals, the beach at Great Kills, and Old Orchard shoals were uncovered for several miles. The "middle grounds" off Seguine's Point were nearly dry, which is an unusual occurrence. The Staten Island ferry-boats experienced difficulty in making their landings.

Low tides also occurred at New London, Connecticut, on the 28th, and at Cedar Keys, Florida, on the 15th, 16th and 17th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for December, 1883, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 84.90 per cent. The percentages for the four elements are: weather, 87.32; direction of the wind, 82.20; temperature, 85.09; barometer, 84.80 per cent. By geographical districts they are: for New England, 85.20; middle Atlantic states, 86.69; south Atlantic states, 82.57; eastern Gulf, 83.60; western Gulf, 85.65; lower lakes, 86.38; upper lakes, 86.04; Ohio valley and Tennessee, 84.44; upper Mississippi valley, 84.00; Missouri valley, 83.38; north Pacific, 89.77; middle Pacific, 87.00; south Pacific, 93.20.

There were forty-nine omissions to predict out of 3,813, or 1.29 per cent. Of the 3,764 predictions that have been made, one hundred and twenty-nine, or 3.43 per cent., are considered to have entirely failed; one hundred and thirty-one, or 3.48 per cent., were one-fourth verified; four hundred and forty-seven, or 11.88 per cent. were one-half verified; four hundred and seventy-one, or 12.51 per cent., were three-fourths verified; 2,586, or 68.70 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During December, 1883, two hundred and eight cautionary signals were displayed. Of these, one hundred and eighty-six, or 89.4 per cent., were justified by winds of twenty-five miles, or more, per hour, at or within one hundred miles of the station. Sixty-six cautionary off-shore signals were displayed, of which number sixty, or 90.9 per cent., were justified both as to direction and velocity; and sixty-one, or 92.4 per cent., were justified as to direction. There were no "northwest" signals ordered on the lakes during the month. Two hundred and seventy-four signals of all kinds were displayed, of which two hundred and forty-six, or 89.8 per cent., were fully justified. These do not include signals ordered at display stations where the velocity is only estimated. Six signals were ordered late. Of the sixty-six cautionary off-shore signals that were displayed, twenty-five were changed from cautionary signals.

Seventy-nine cases have been reported from the various signal stations in which the maximum hourly velocity of the wind reached twenty-five or more miles, and for which signals had not been ordered to be displayed. These were from scattered stations as a rule, and it is not believed that any damage resulted from dangerous winds, as generally fair weather prevailed. On the 1st signals were ordered up for all lake stations excepting Duluth, Marquette, and Escanaba; subsequent changes proved that signals should have been hoisted at those stations also, as high northwesterly winds prevailed over that region on the 1st and 2d in the western quadrants of low area i., but with generally fair weather. At Buffalo and Rochester the signals were lowered too soon on the 8th. High westerly winds occurred on Lakes Michigan and Huron, night of the 9th, and 10th, during the progress of low area v., for which signals had not been ordered, but fair weather was general; the lower lake stations were warned, morning of the 10th. High northeasterly winds, with rain, were reported from the central portion of the North Carolina coast on the 9th, for which signals should have been displayed. The "norther," for which off-shore signals were displayed on the Texas coast on the 13th, 14th, and 15th, extended eastward across the Gulf; if signals had been displayed at New Orleans and Cedar Keys they would have been justified, as velocities of n. 28 and nw. 29 miles, respectively, were registered. On the 14th signals were ordered up along the coast from Maine to Cape Hatteras, in advance of low area vii., but high westerly winds also occurred along the southern portion of the North Carolina coast. For the storm, low area xii., which appeared off the middle Atlantic coast on the 21st, no signals were ordered, and high northeast backing to northwest winds were produced along the New Jersey and New England coasts. At midnight of the 24th, after low area xiv. had passed northeastward along the New England coast, the signals were lowered, but subsequent reports proved that at Block Island and the New Jersey coast stations they should have been retained twenty-four hours longer.

Professor T. C. Mendenhall, director of the Ohio Meterological Bureau, in his report for December, 1883, says:

> It is found, from special reports made to the bureau, that the percentage of verifications of the railway train weather signals was eighty-six per cent. for the month of December.

These signals consist of colored symbols, displayed from the sides of the baggage cars of the Cleveland, Akron, and Columbus railroad company, representing the daily forecasts, as telegraphed from the Office of the Chief Signal Officer to said bureau.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at the Signal Service stations during December, 1883, with the average depth at which the observations were made, and the mean temperature of the air at the several stations, are shown in the following table. On account of ice-formation observations were not made at the following stations on the dates named: Alpena, Michigan, from 16th to 31st; Mackinaw City, Michigan, on the 14th and 15th, and from 17th to 31st; Escanaba, Michigan, on the 15th, 16th, and 17th, and from 19th to 31st; at Chicago, Illinois, Duluth, Minnesota, Marquette, Michigan, Milwaukee, Wisconsin, and Toledo, Ohio, from 17th to 31st; Sandusky, Ohio, from 16th to 31st; Detroit, Michigan, from 22d to 31st; Grand Haven, Michigan, on 22d and 23d; Buffalo, New York, on 23d, 24th, 25th, 29th, 30th, 31st; Boston, Massachusetts, 23d. The highest temperatures observed during the month are reported from Key West, Florida, (76°.9 on the 28th); Cedar Keys, Florida, (74° on 7th); and Galveston, Texas, (69° on 23d). The largest monthly ranges are: 34°.1 at Cedar Keys, Florida; 24°.6 at Toledo, Ohio, (record from 1st to 16th); 19° at Galveston. The smallest monthly ranges are: 2°.3 at San Francisco, California; 5°.4 at Portland, Oregon; 5°.7 at Savannah, Georgia.

Temperature of water for December, 1883.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.		Mean temperature of the air at station.
	Max.	Min.				
	°	°	°	ft.	in.	°
Atlantic City, New Jersey	47.1	35.6	11.5	5	11	37.2
Alpena, Michigan*	34.7	30.5	4.2	11	9	23.3
Augusta, Georgia	56.0	46.0	10.0	6	2	53.2
Baltimore, Maryland	45.0	35.0	10.0	9	10	39.0
Block Island, Rhode Island	47.2	30.8	16.4	8	3	35.0
Boston, Massachusetts *	41.0	29.5	11.5	22	5	28.7
Buffalo, New York *	40.2	32.2	8.0	10	0	34.0
Cedar Keys, Florida	74.2	40.1	34.1	11	7	67.1
Charleston, South Carolina	58.7	51.9	6.8	40	1	56.0
Chicago, Illinois *	38.9	34.3	4.6	8	1	30.1
Chincoteague, Virginia	49.0	32.5	16.5	5	0	40.9
Cleveland, Ohio	41.2	32.0	9.2	14	0	32.2
Detroit, Michigan*	39.2	33.0	6.2	22	2	33.5
Delaware Breakwater, Delaware	48.2	37.8	10.4	7	7	39.5
Duluth, Minnesota *	36.6	35.1	1.5	14	10	15.7
Eastport, Maine	43.7	37.5	6.2	16	2	23.4
Escanaba, Michigan*	38.5	31.5	7.0	15	0	20.1
Fort Canby, Washington Territory	47.0	37.2	9.8	17	6	44.2
Fort Macon, North Carolina	58.7	49.0	9.7	2	11	50.0
Galveston, Texas	69.0	50.0	19.0	10	7	60.2
Grand Haven, Michigan *	37.8	31.6	6.2	19	0	30.6
Indianola, Texas	67.7	50.0	17.7	8	0	59.5
Jacksonville, Florida	65.0	56.0	9.0	18	0	60.5
Key West, Florida	76.9	71.0	5.9	17	8	71.5
Mackinaw City, Michigan *	38.5	31.6	6.9	10	0	24.9
Marquette, Michigan *	36.0	34.0	2.0	9	10	21 1
Milwaukee, Wisconsin *	37.5	34.5	3.0	8	0	26.4
Mobile, Alabama	62.0	53.0	9.0	14	4	56.4
New Haven, Connecticut	40.3	31.2	9.1	15	6	29.7
New London, Connecticut	40.0	38.0	8.0	12	7	31.5
New York City	44.0	31.3	12.7	10	4	33.7
Norfolk, Virginia	49.5	42.0	7.5	16	7	46.4
Pensacola, Florida	63.9	56.6	7.3	16	8	57.9
Portland, Maine	40.0	30.5	9.5	14	10	27.7
Portland, Oregon	46.1	40.7	5.4	56	5	41.8
Provincetown, Massachusetts	43.8	29.3	14.5	11	1	32.9
Sandusky, Ohio *	40.5	35.0	5.5	9	8	33.3
Sandy Hook, New Jersey	45.0	35.8	9.2	1	6	35.4
San Francisco, California	52.1	49.8	2.3	39	8	50.2
Savannah, Georgia	57.0	51.3	5.7	11	9	57.1
Smithville, North Carolina	64.5	50.2	14.3	10	0	51.7
Toledo, Ohio*	58.9	34.3	24.6	10	6	32.7
Wilmington, North Carolina	54.0	47.0	7.0	20	10	52.8

*Observations interrupted by ice; see text.

ATMOSPHERIC ELECTRICITY.

AURORAS.

There were no unusually brilliant or widely-extended auroral displays observed in the United States during December. The most noteworthy display of the month occurred on the night of the 1st. This display was noted by scattering observers from eastern New England to northwestern Dakota, the most numerous reports coming from the upper lake region. The following notes relating to this display have been received:

Eastport, Maine, 1st.—A faint auroral arch was observed, from 6.40 to 7.40 p. m.

Gardiner, Maine, 1st.—A brilliant auroral light, extending from northwest to northeast, was observed at 6 p. m.